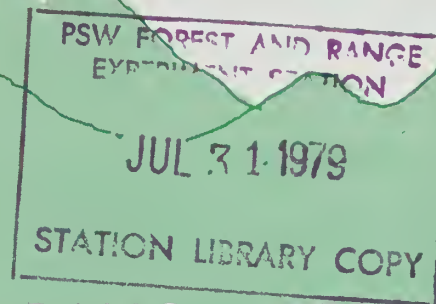


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FOREST SERVICE,  
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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

## Eastern Redcedar Seed Sources Recommended for North Dakota Sites

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### Abstract

A North Dakota study of 12 eastern redcedar (*Juniperus virginiana* L.) seed sources indicates that seed from planted stands near Anselmo, Custer County, Nebr.; from a shelterbelt at Towner, N. Dak.; and from native stands in western Wisconsin and western Minnesota can be recommended for most North Dakota sites.

### Management Implications

Survival and subsequent height growth of trees from four, and perhaps five, seed sources has been good enough to make it worthwhile for land managers and tree planters to request stock from those provenances.

Seed sources from Custer County, Nebraska (2810), western Wisconsin (2806), a planted shelterbelt at Towner, N. Dak. (2809), and western Minnesota (2808), are adapted to sites similar to the Denbigh Experimental Forest. Survival of trees from these sources has been good. Because height growth has been so affected by browsing, it is not possible to know how well the trees would have grown under conditions of less deer pressure; but, juniper stock from these four sources can be recommended for most North Dakota planting sites.

A fifth source, Nebraska 3211, may also be worth strong consideration for North Dakota

plantings. Once established, these trees grew as well as trees from three of the four recommended sources.

More definitive site-seed source recommendations will be possible later from a cooperative regional study of eastern redcedar and Rocky Mountain juniper seed sources. However, seedlings from that study are still in nursery beds. The regional juniper test may identify several seed sources that are better than the ones recommended from this test, but results from the regional test are still many years away.

### Introduction

In the northern Great Plains, where only a few local areas have native trees, protection from the characteristic climatic extremes can best be provided by introduced, adapted tree species.

Hardy trees with year-round foliage are in demand for environmental enhancement plantings in the northern Great Plains. In addition to being evergreen, conifers have another advantage over deciduous trees in that

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once the crown is groomed to meet a user's goals, little or no additional crown treatment is needed.

Eastern redcedar (*Juniperus virginiana* L.) has proved adapted to many planting situations in the Great Plains (George 1953, Read 1958), but seed sources have not been delineated that will provide uniformly fast growing, hardy, well formed trees for planting in the northern Great Plains.

The native range of eastern redcedar in North Dakota is an isolated occurrence in two southwestern counties, Billings and Grant. Native Rocky Mountain juniper (*Juniperus scopulorum*), on the other hand, is found in scattered locations in the western third of North Dakota (Fowells 1965). Van Haverbeke (1968) found *Juniperus* populations in North Dakota were strongly influenced by the parental type *J. scopulorum*. In fact, the *Juniperus* stands in the whole Missouri River Basin region may be of hybrid origin. Those in the northwest half of the Basin were influenced more by the Rocky Mountain juniper parental type, while stands in the southeastern half exhibited greater influence by the eastern redcedar parental type.

Tree characteristics often vary according to seed source. Growth, survival, and winter foliage color frequently are influenced strongly by provenance in junipers. Cedar-apple rust (*Gymnosporangium juniperi-virginianae*) is sometimes so debilitating to apple trees that apples cannot be grown near junipers.

This study was installed as part of the continuing search for suitable species to meet environmental planting needs for the region. It was begun as a cooperative test of eastern redcedar with the former Central States Forest Experiment Station. This was the only test from that study made in a northern Great Plains climate.

### The Study

The Denbigh Experimental Forest is a 640 acre block of land in McHenry County. Soils at Denbigh and in the surrounding area are nearly pure sand. On the Experimental Forest water is abundant in most years within 6 feet of ground surface. Before tree planting began at Denbigh in the early 1930's, the topography was sandy

dunes with native range grasses and forbs as a sparse ground cover. The area was locally known as the Denbigh Dunes. Now, the soils have been stabilized by tree plantations of many species and seed sources.

Forty 2-0 seedlings from each of 12 eastern redcedar sources were hand planted in spring 1964 at 2.1 m<sup>2</sup> spacing on the Experimental Forest.

To identify variations that might be associated with seed sources, periodic measurements and observations were made on test trees. Survival, total height, winter foliage color, animal damage, and presence of cedar-apple rust were measured or evaluated at various times during the 13-year test.

Geographic distribution of the sources is shown in figure 1. Sources of the test seedlings are shown in the following tabulation:

Lake States Exp. Stn. <sup>2</sup> no.	Geographic source and location received from
3206-N-64	Buffalo County, Wis. Cent. States For. Exp. Stn. <sup>2</sup> (#9)
3207-N-64	Mason County, W. Va. Cent. States For. Exp. Stn. (#10)
3208-N-64	Montgomery County, Ark. Cent. States For. Exp. Stn. (#11)
3209-N-64	Trego County, Kans. Cent. States For. Exp. Stn. (#14)
3210-N-64	Madison County, Ky. Cent. States For. Exp. Stn. (#16)
3211-N-64	Seward County, Nebr. Cent. States For. Exp. Stn. (#20)
2805-N-64	Platte River, Nebr. Plumfield Nursery, Fremont, Nebr.
2806-N-64	Western Wis. Lake City Nursery, Lake City, Minn.
2807-N-64	Crescent, Okla. Oklahoma Dep. of Agric.
2808-N-64	Western Minn. Towner Nursery, Towner, N. Dak.
2809-N-64	Unknown (Planted shelterbelt) Towner Nursery, Towner, N. Dak.
2810-N-64	Unknown (Stands near Anselmo, Custer County, Nebr. USDA For. Serv., Halsey, Nebr.

<sup>2</sup>The Lake States and Central States Forest Experiment Stations have been combined into the North Central Forest Experiment Station.

## Results and Discussion

### Survival and Growth

Seedlings from central Nebraska (2810) survived best and were tallest of all sources (table 1). The survival and height growth of all sources, however, may have been influenced by pre- and post-planting conditions. Since trees from sources 2805 through 2810 were raised at different nurseries, their early performance could be confounded by nursery effects. By 1976, any early nursery effects should have disappeared.

The Seward County, Nebraska source (3211) has kept up height growth along with the rest of the best ranking sources. Its survival has been low; but, perhaps because of freezing and drying before planting, only a dozen really vigorous trees were planted.

Survival of Nebraska sources 2805 and 3211 may have been low in the beginning because of poor tree vigor at planting time. Neither of those sources has had much mortality since 1967 (table 1).

Trees from seed sources 2809 and 2810 were grown at the Towner, N. Dak. nursery. Otherwise, the stock from sources 2805 through 2810 were raised at different nurseries. Trees from sources 3203 through 3211 all were grown at the George White State Nursery, Licking, Mo.

Trees from the George White Nursery were frozen in transit from their Missouri shipping point to North Dakota. Also they dried out somewhat during the cold (4° C) storage period between delivery and planting.

The plantation consists of 10 replications of 4-tree plots. The planting site was plowed in 1963, then cultivated and disked prior to planting. The site was sod- and weed-free at planting time. Seedlings that died were replaced in spring 1965 from line-out beds at the Towner, N. Dak. nursery with seedlings of appropriate sources.

Grass and forb competition was minimized in the first year by repeated cultivation between rows and between trees within rows. Thereafter, the plantation was cultivated once annually through 1969. No cultural treatments were applied after 1969.

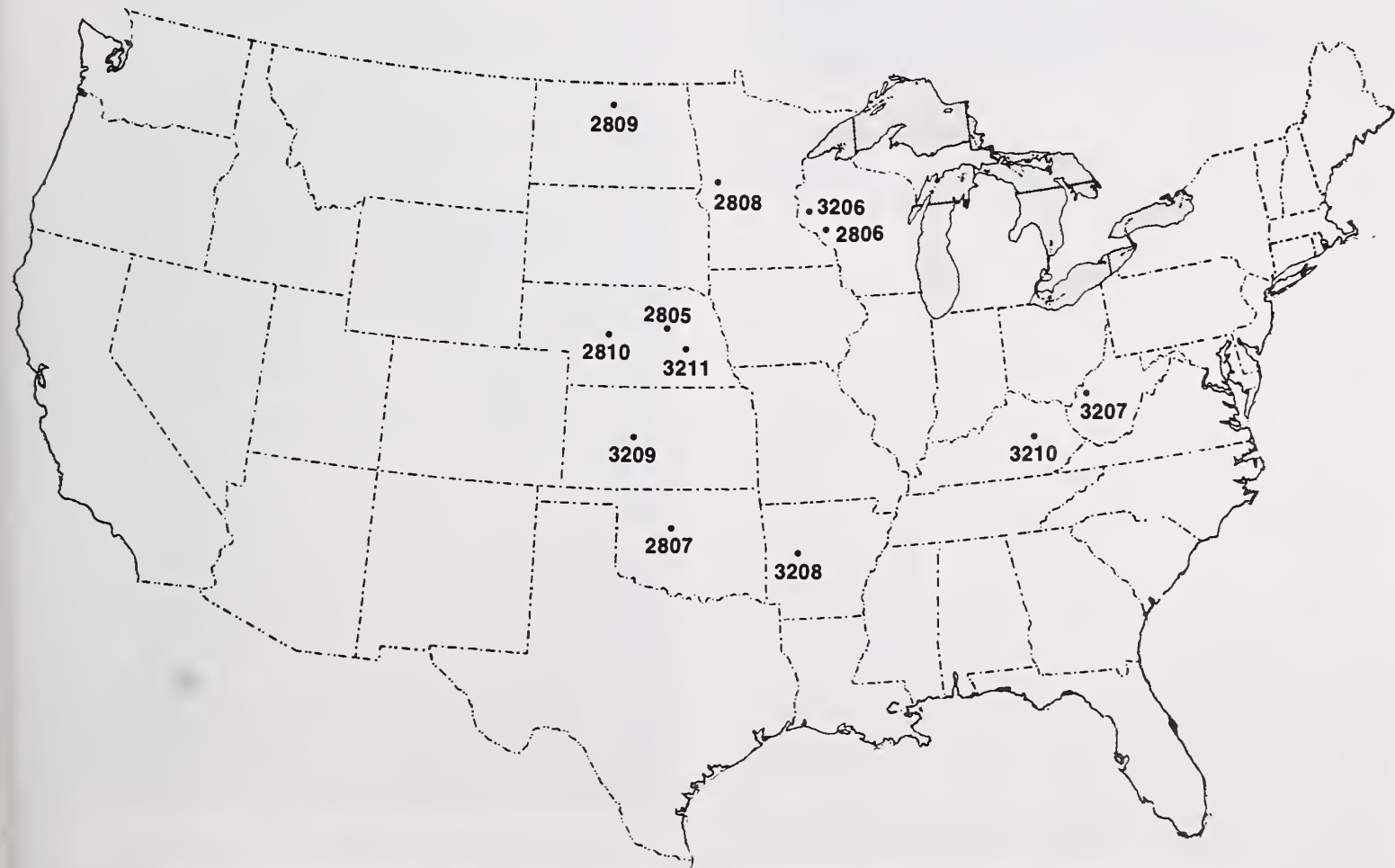


Figure 1.—Geographic distribution of eastern redcedar seed sources being tested on the Denbigh Experimental Forest in north central North Dakota.



Table 1.—Survival and total height of 12 seed sources of eastern redcedar on the Denbigh Experimental Forest in north central North Dakota

Source	1967 (4 yrs.)		1973 (10 yrs.)		1976 (13 yrs.)			Foliage color		
	Survival	Height	Survival	Height	Survival	Height <sup>1</sup>	Percent <sup>2</sup>	Red	Purple	Green
	(%)	(cm)	(%)	(cm)	(%)	(cm)		(%)		
2809 N. Dak. shelterbelt	98	38	98	124	98	179 b	107	41	54	5
2808 Minn.	92	40	92	116	92	179 bc	106	43	38	19
2806 Wis.	78	48	75	138	75	183 b	109	40	23	37
3206 Wis.	75	38	72	113	72	134 de	80	38	59	3
3211 Nebr.	30	24	30	109	28	173 bc	103	17	58	25
2805 Nebr.	28	22	22	106	20	147 cd	87	11	56	33
2810 Nebr. plantation	100	47	100	128	100	205 a	122	32	32	36
3209 Kans.	45	19	45	85	45	109 e	65	44	17	39
3207 W. Va.	20	15	15	66	15	64 f	38	33	0	67
3210 Ky.	0									
2807 Okla.	0									
3208 Ark.	0									
Plantation Mean						168				

<sup>1</sup>Means followed by the same letter are the same ( $>0.05$ ).

<sup>2</sup>Percent of plantation mean.

All but one of the six best-growing sources can be considered central and northern Great Plains sources. An exception is western Wisconsin (2806). Even though that source is not from a Great Plains longitude, it originates from a latitude similar to those from the central and northern Plains.

Trees from Nebraska seed sources generally survived and grew well. Plant material can often be moved relatively short distances northward with improved growth. Early indications from provenance tests of ponderosa pine and green ash in North Dakota are that trees from certain Nebraska sources grow better than trees from local North Dakota sources.

Trees from several sources showed some promise, but their combined performance of survival and height growth has made them poor candidates for North Dakota. For example, trees from sources 3206 (Wisconsin) and 3209 (Kansas) survived reasonably well after their initial losses, but their height growth was not good. All trees died from a single seed source each in Kentucky, Oklahoma, and Arkansas. They were evidently unable to withstand the harsh climatic conditions of the test site.

## Winter Foliage Color

Winter color is one of the foliage characteristics associated with regional distribution of *Juniperus* (Van Haverbeke and Read 1976). Foliage color was evaluated during winter 1973). Only three colors were tallied: red, purple, and green. Seed sources and corresponding percentage of the trees predominantly displaying one of the colors is shown in table 1.

Trees from northern latitude sources (2809, 2808, 2806, 3206) were about equally divided between red and purple foliage, with relatively few green trees. Trees from Nebraska (3211, 2805, 2810, 3209) were most often purple or green. Minckler and Ryker (1959), however, found no predominantly green winter foliage among trees from Nebraska seed sources.

Trees from the Kansas source were mostly red or green, while the trees from West Virginia were only red or green. Minckler and Ryker (1959) also reported no purple winter foliage color among trees from far-eastern U.S. sources.

## Animal Damage

Past experience in the Denbigh Experimental Forest indicates juniper is susceptible to deer browsing. Habitat on the experimental forest is highly suitable for deer. Deer have browsed heavily on nearly all trees in this plantation, without apparent preference for any sources. One of the trees from Nebraska source 2810 that was not heavily browsed has developed well (fig. 2). Adapted trees will eventually grow above deer browse height, but browsing effects will remain (fig. 3). In some cases, multiple stems were probably caused by deer browsing. More deer activity is concentrated in this plantation than would be found in an average farmstead or field windbreak. Browsing could



Figure 2.—Tall, moderately dense crown tree from Custer County, Nebraska seed source 2810, free of deer browsing.



Figure 3.—Browsing by deer has reduced wind control effectiveness of this tree, even though the top is now above browse height.

be a problem, however, if juniper windbreaks are located near other areas that provide good deer habitat.

Rabbits and mice sometimes damage junipers. They have caused only minor damage in this plantation. One reason may be because they have many other food sources on the Experimental Forest.

## Cedar-apple Rust

Where apple trees grow in the vicinity of junipers, cedar-apple rust infections are common. Very few rust infections were noted, and no pattern of source related infections appeared among the test trees. This is probably because apple trees are not grown in the Experimental Forest vicinity.



### Literature Cited

- Fowells, H. A. 1965. Silvics of forest trees of the United States. U.S. Dep. Agric., Agric. Handb. 271, 762 p.
- George, Ernest J. 1953. Tree shrub species for the northern Great Plains. U.S. Dep. Agric. Circ. 912, 46 p.
- Minckler, Leon S., and Russell A. Ryker. 1959. Color, form, and growth variations in eastern redcedar. J. For. 57(5):347-349.
- Read, Ralph A. 1958. The Great Plains shelterbelts 1954. Nebr. Agric. Exp. St. Bull. 441 (Great Plains Agric. Counc. Publ. 16), 125 p.
- Van Haverbeke, David F. 1968. A population analysis of *Juniperus* in the Missouri River Basin. Univ. Nebr. Student News Serv. 38, 82 p.
- Van Haverbeke, David F., and Ralph A. Read. 1976. Genetics of eastern redcedar. USDA For. Serv. Res. Pap. WO-32, 17 p. U.S. Dep. Agric., For. Serv., Wash., D.C.





